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E04G 21/32

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E1S SL

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GB 2219826 A GB 2071196 A EP 0141730 A
US 4932185 A US 4171032 A

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(71) Applicant
Henry Crawford
29 Tullialan Place, East Kilbride, Glasgow, G74 2EG, United Kingdom

(72) Inventor
Henry Crawford

(74) Agent and/or Address for Service
Cruikshank & Fairweather
19 Royal Exchange Square, Glasgow, G1 3AE, United Kingdom

# (54) Improved roof anchor

(57) A roof anchoring device comprises rafter attachment means (11) for securing to a beam or the rafter (16) of a roof and harness attachment means (13) which is coupled to the rafter attachment means at upper and lower points. A tubular pedestal (14) is secured to the rafter attachment means (11) and an eyebolt 22 extends through the length of the pedestal for receiving a lanyard or safety harness. The attachment means comprises a U-shaped bracket (34) secured to the rafter at points which are sufficiently spaced apart so as to counteract bending moments applied by loading via the harness and eyebolt (22).

The bracket (34) is clamped around the rafter (16) without penetrating or otherwise weakening the rafter. The pedestal (14) is clamped to the U-shaped bracket by an L-shaped bracket (28) and boss (30) substantially over the depth of the rafter and at or near the upper end of the rafter bracket. The pedestal (14) can be adjusted relative to the bracket (34).

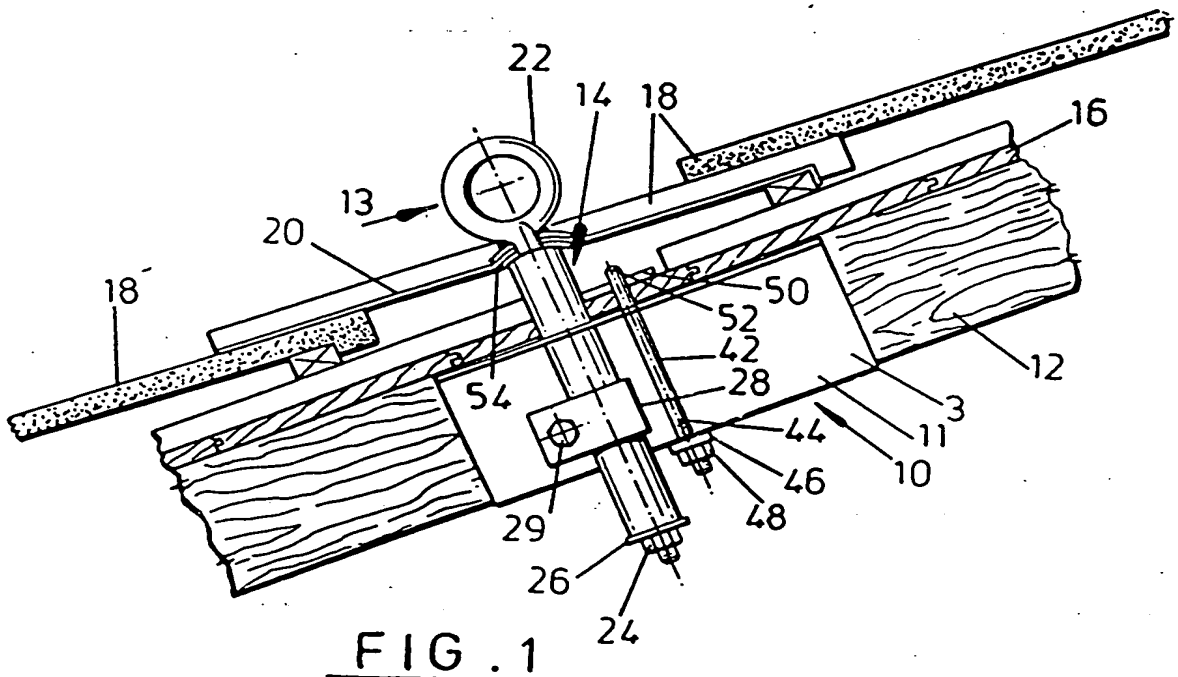


FIG. 1



GB 2 251 020 A

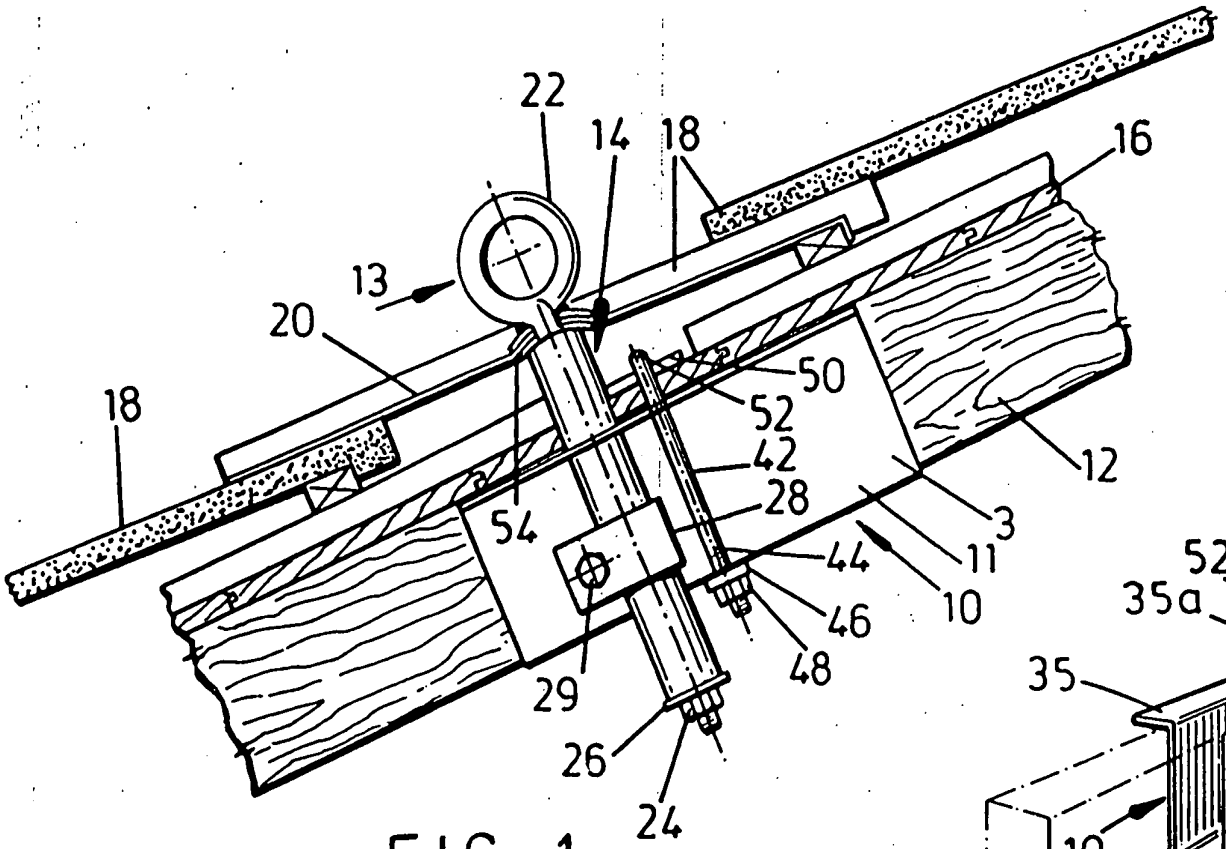
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FIG. 1

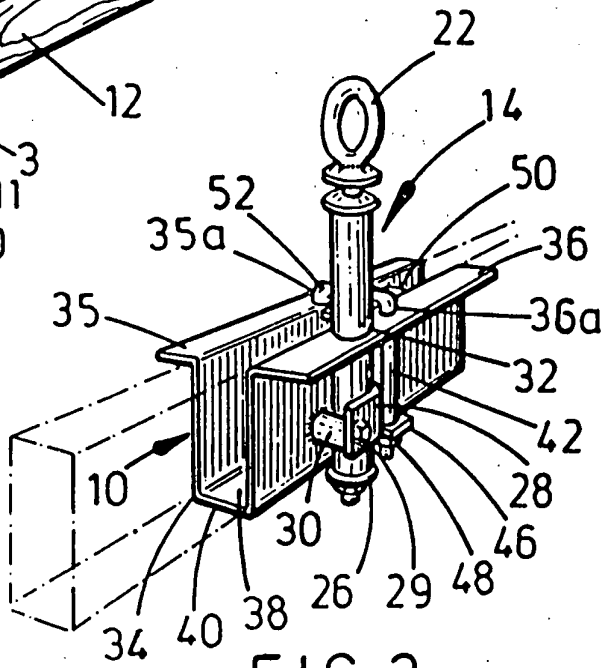
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FIG. 2

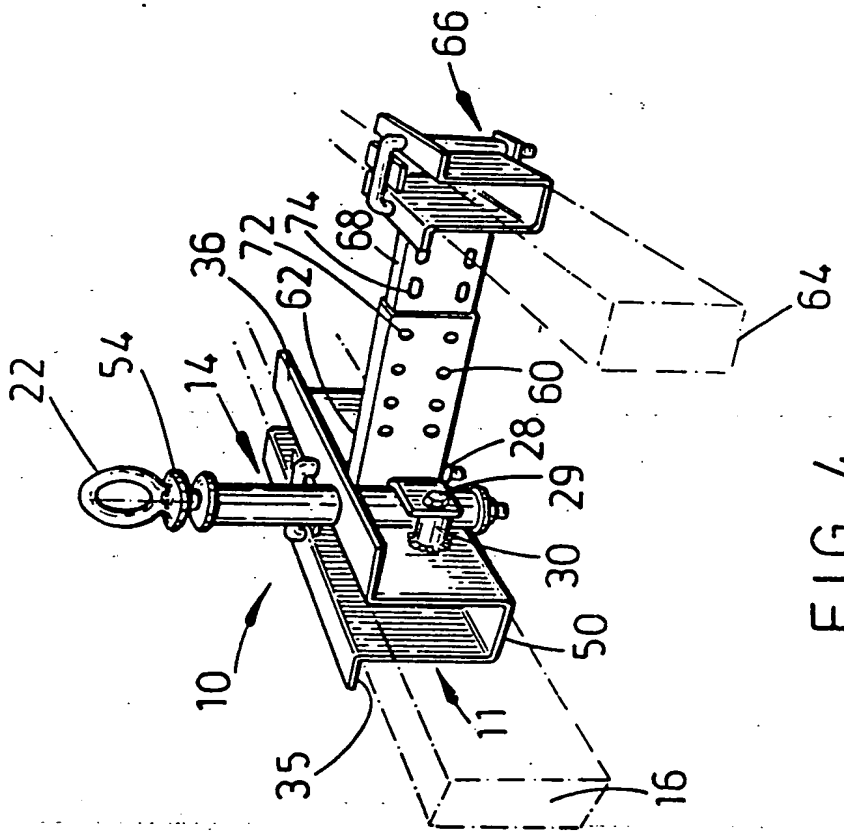
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FIG. 4

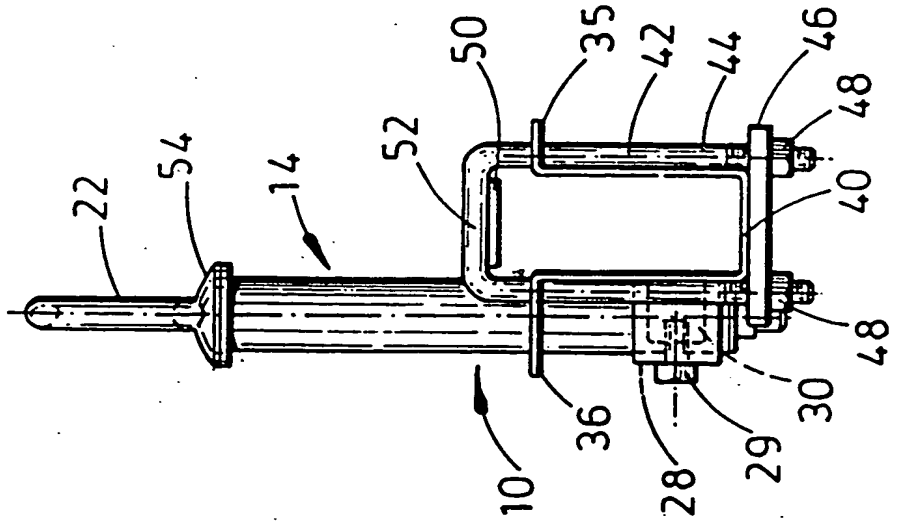
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FIG. 3

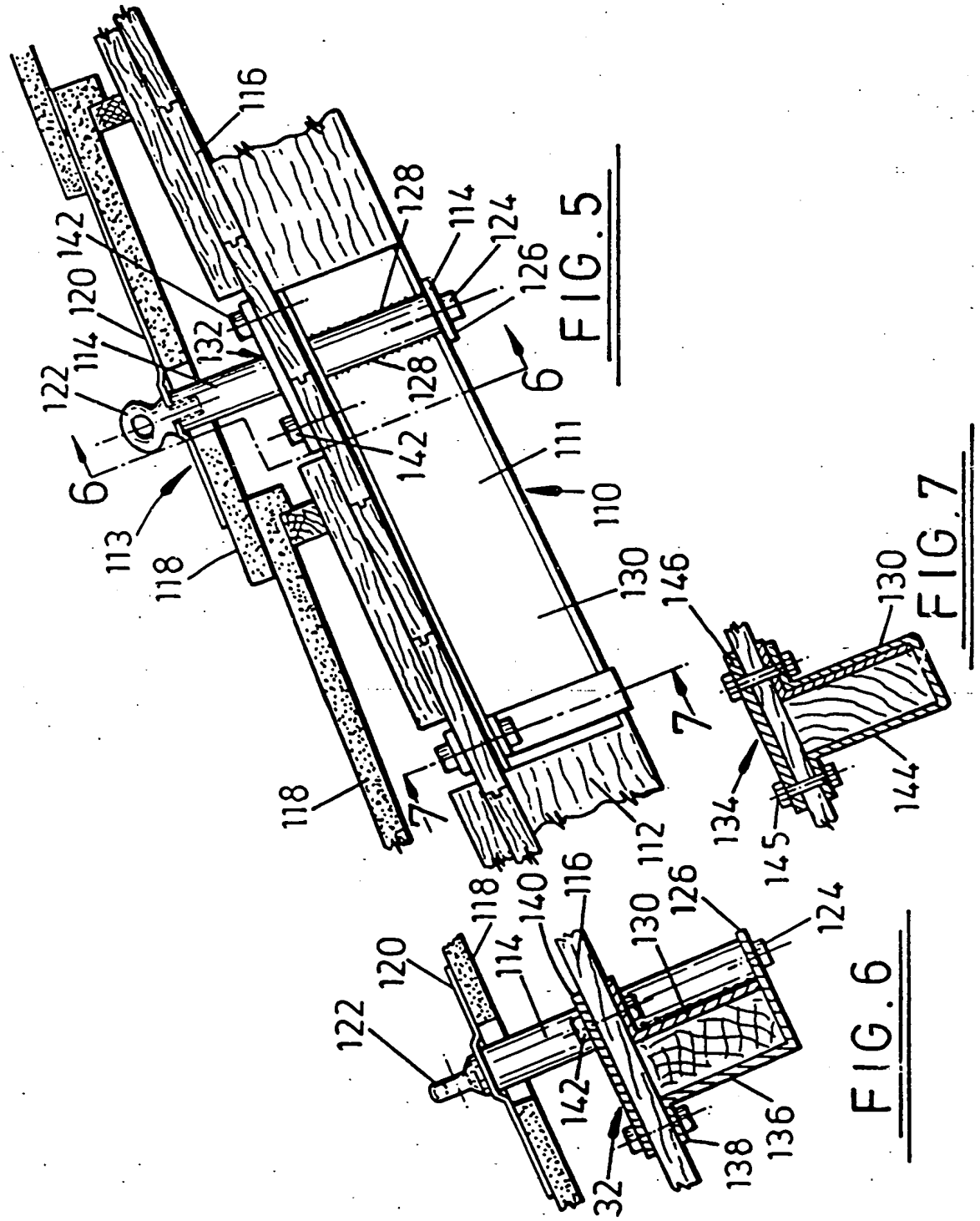


FIG. 5

FIG. 7

FIG. 6

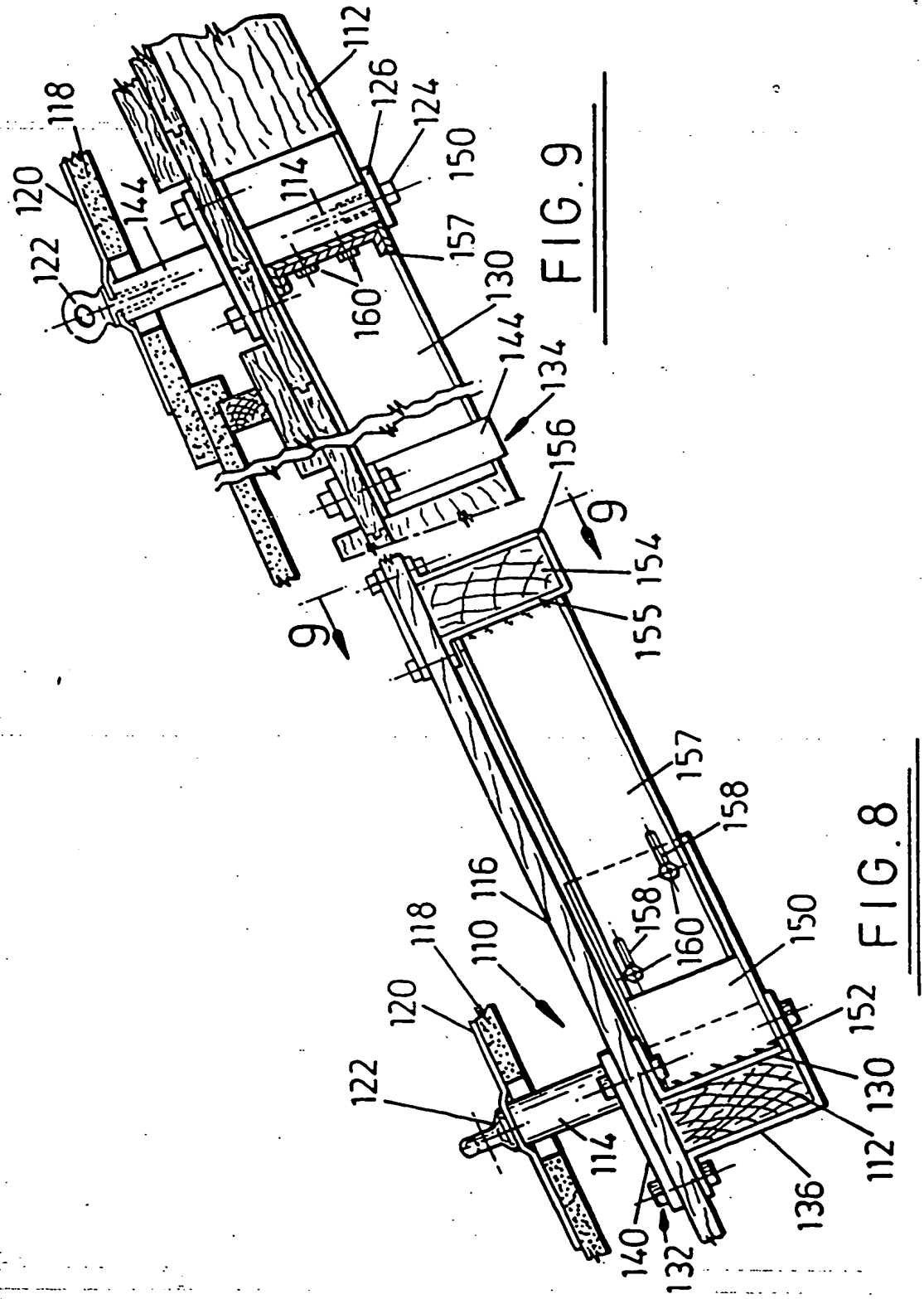
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FIG. 9

FIG. 8

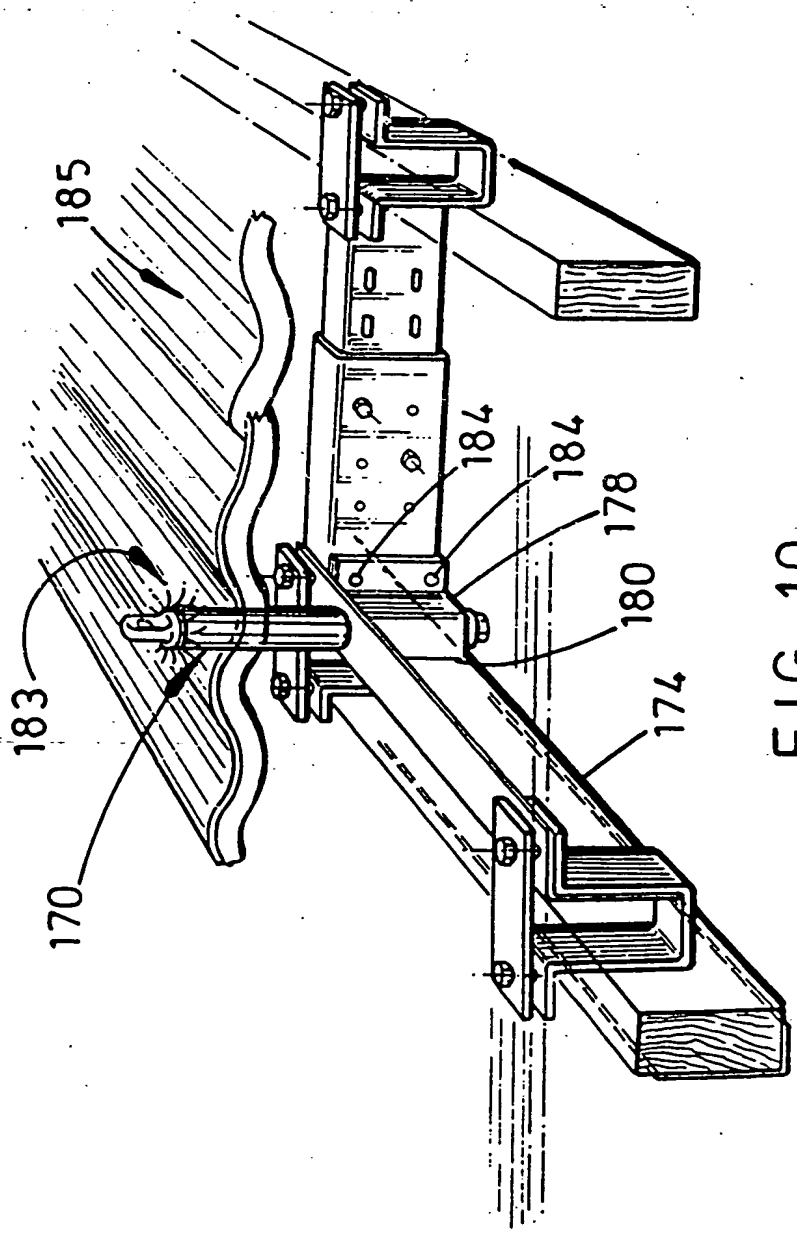


FIG. 10

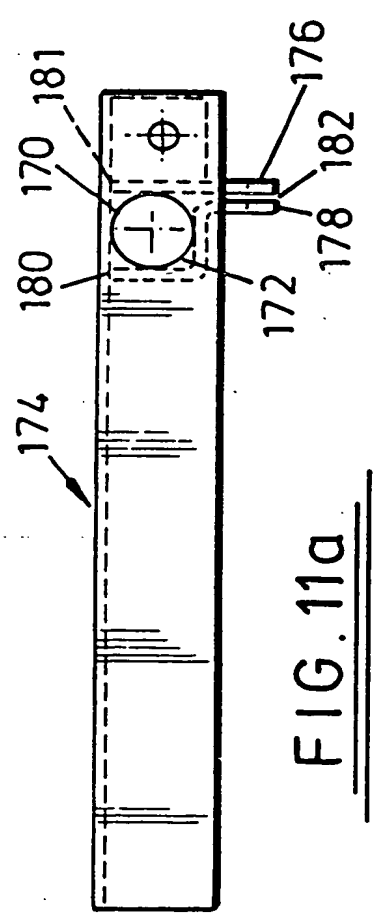


FIG.11a

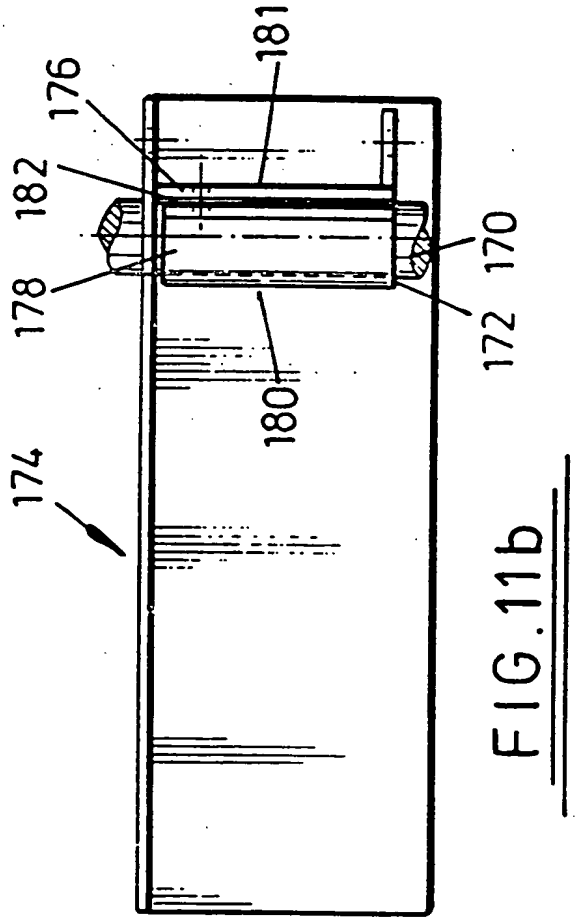


FIG.11b

# IMPROVED ROOF ANCHOR

The present invention relates to an anchoring device and particularly, but not exclusively, to an anchoring device for use on sloping roofs and to which a lanyard with a safety harness or anchorage line with safety harness or other similar device, may be secured.

Conventional roof anchoring devices may be secured to various elements of a roof such as the rafter or the ridge so that an anchoring element, usually an eyebolt, projects through the roof surface and to which a safety harness or the like can be secured. British Patent Specification No. GB 2071196A discloses a safety anchorage device for the roof of a ridge roof building and this device is secured to the ridge of the roof. The device is not really suitable for use on a sloping roof and one disadvantage of this device is that the workman requires to ascend to the ridge of the roof for attaching and detaching the safety harness. British Patent No. 2219826 discloses a safety device for use on a sloping roof which consists of a clamp which is attached to a rafter and which has an extending portion away from the rafter. A shaft in the form of an eyebolt projects through the extending portion and also through the external covering of the roof such as the tiles and sarking so that the eyebolt appears on the roof structure.

The device in British Patent No. 2219826A is limited in its application by the torsional stiffness of the rafter to which it is attached. At the gable ends or hip ends of roofs, the roof structure requires to be considerably reinforced and stiffened to counteract the torsional effect imparted by this latter anchor in the event of the arrest of a possible fall of the harness wearer.

The same device has also required modification and extension in its scope to reduce bending of the eyebolt at low loads, and to reduce damage to the rafter when the eyebolt is loaded in its usual direction, in the direction of the slope.

An object of the present invention is to provide an improved anchoring device which obviates or mitigates, at least one of the aforementioned problems.

This is achieved by providing a roof anchoring device comprising rafter attachment means for securing to a beam or rafter of the roof, harness attachment means coupled to said rafter attachment means, a pedestal extending from the eye of the harness attachment means to the bottom of the rafter attachment means and the pedestal being secured substantially over the depth of the rafter attachment means to a bracket mounted on the rafter. Furthermore, the bracket is secured to the rafter at locations which are sufficiently spaced-apart so as to counteract bending moments applied by loading via the harness and eyebolt.

Also, the pedestal has a cross-section sufficient to provide a modulus of stiffness so that the pedestal and harness attachment means are subject to minimal deflection when loaded under intended conditions.

In one arrangement, the rafter attachment means is a generally U-shaped bracket and clamps around the rafter without penetrating or otherwise weakening the rafter. The eyebolt is fastened into a tubular sleeve which is welded at one side to the rafter bracket over the depth of the rafter, and at or near the upper end of the rafter bracket.

According to one aspect of the present invention, there is provided an anchoring device for use on a roof having a plurality of beams or rafters with external covering means thereon, said anchoring device having beam or rafter attachment means for securing to a beam or rafter and roof anchor means having support means secured to said rafter attachment means at least at spaced apart upper and lower points, and said support means having a cross-section sufficient to provide a modulus of stiffness so that the roof anchor means is subject to minimal deflection when loaded under intended conditions.

Preferably, the roof anchor means further comprises harness attachment means projecting through the roof covering, and said support means being coupled between the harness attachment means and the rafter attachment means.

Conveniently, the harness attachment means is an

eyebolt and the support means is a tubular pedestal through which the eyebolt passes. In one alternative arrangement, the pedestal is secured to the rafter attachment means by friction and the pedestal is adjustable relative to the rafter attachment means in-situ. In particular, the rafter attachment means is a U-shaped channel member secured to the rafter over its length, said channel member having an aperture to receive the pedestal, and bracket means for clamping said pedestal.

Alternatively, the rafter attachment means is secured to the rafter at points which are spaced apart a distance greater than the length of the roof anchor means. In this case, the rafter attachment means consists of a substantially L-shaped bracket located along one side of the rafter and which is secured by brackets at two spaced-apart points along the length of the rafter.

Advantageously, the tubular pedestal is of circular cross-section, although it may be of square or any other suitable cross-section.

Additionally, the anchoring device includes second rafter attachment means for location on a second rafter adjacent to said rafter and support means coupled to said first and said second rafter attachment means, the arrangement being such that, in use, said additional support is substantially perpendicular to the slope of the roof. This support means is conveniently adjustable whereby the distance between said first and second rafter

attachment means can be adjusted.

These and other aspects of the present invention will become apparent from the following description when taken in combination with the accompanying drawings in which:-

Fig. 1 is a diagrammatic view of a cross-section through a roof showing part of a rafter fitted with an anchoring device in accordance with a first embodiment of the present invention;

Fig. 2 is a perspective view of the anchoring device of Fig. 1 drawn to a reduced scale;

Fig. 3 is an end elevation of the roof anchor of Fig. 1 taken in the direction A with the pedestal fully extended;

Fig. 4 is a perspective view of the roof anchor of Fig. 2 modified for use at gable or hip-end applications;

Fig. 5 is a diagrammatic view of a cross-section through a roof showing part of a rafter fitted with an anchoring device in accordance with a second embodiment of the present invention;

Fig. 6 is a sectional view taken on the lines 6-6 shown in Fig. 5;

Fig. 7 is a sectional view taken on the lines 7-7 in Fig. 1;

Fig. 8 depicts the anchoring device shown in Figs. 5-7 modified and in use in a hip-end roof;

Fig. 9 is a view of the anchoring device shown in Fig. 8 taken in the direction 9.

Fig. 10 is a perspective diagrammatic view of a roof, partly broken away, with a rafter fitted with another alternative embodiment of the invention;

Fig. 11a and 11b depicts enlarged top and side view of part of the anchorage bracket shown in Fig. 10.

Reference is first made to Figs. 1-3 of the drawings which depict a roof anchor generally indicated by reference numeral 10 mounted on a rafter 12. The roof anchor 10 consists of rafter attachment means 11 for securing the device 10 to the rafter 12 and harness attachment means 13 in the form of a pedestal 14 which projects through the sarking 16, tiles 18 and lead slatepiece 20 and which terminates in a stainless steel eyebolt 22 to which a lanyard with safety harness can be fastened in the usual manner. The eyebolt 22 extends through the length of the pedestal 14 and is fastened at the other end by a nut 24 and a washer 26. The pedestal is circular in cross-section and secured to the rafter attachment means 11 as best seen in Figs. 1 and 2 by means of an L-shaped bracket 28 which receives a bolt 29 for engaging a threaded boss 30 welded to the rafter attachment means. The pedestal 14 also passes through a circular aperture 32 in rafter attachment means 11 which is slightly larger than the pedestal diameter.

This secure fastening of the eyebolt 22 through the pedestal 14, and of the pedestal 14 to the rafter attachments means, ensures that any bending moment applied

via the eyebolt 22 to the rafter attachment means 11 is strongly resisted by the bracket 28 and boss 30 and by the spaced-apart circular aperture 32.

The rafter attachment means 11 comprises a generally U-shaped bracket 34 (as best seen in Fig. 2) of substantially the same depth as the rafter 12 and which extends along the length of the rafter for a distance which is sufficient to resisting torsional forces as will be described. The U-shaped bracket 34 is formed from mild steel with two integral plates 35,36 which extend the length of the bracket and which, in use, as seen in Fig. 1, has a small clearance with the sarking 16 when the means 11 is attached to the rafter 12. The bracket 34 has two spaced holes 38 (one of which is shown) in the base 40 of the U-channel which allow the bracket to be nailed or screwed to the rafter 12 during installation.

The roof anchor is straightforward to install; first tiles 18 and fastening are removed to expose the sarking. The U-shaped bracket 34 is then nailed in place and a hole is drilled through the sarking to receive the pedestal 14. Two smaller holes are drilled through the sarking using apertures 35a,36a in the plates as templates. A U-bolt 42 with free ends 44 is passed through the holes from the roof side and is fastened securely around the bracket 34 and rafter 12 by a plate 46 and nuts 48. A plate 50 is also welded to the cross-piece 52 of the U-bolt 42 so that the U-bolt does

not crease or damage the rafter when it is secured thereto.

The pedestal is then passed through the aperture and adjusted to a suitable height, as shown in Fig. 1. At this height bolt 29 is tightened to clamp the pedestal 14 with bracket 28. The slatepiece is then fitted and is secured at the top of the pedestal between the concave washers 54 forming a waterproof seal as disclosed in co-pending U.K. Patent Application No. 9119684.0. The tiles are replaced to complete installation.

It will be appreciated that the rafter bracket 34 is securely fastened to the rafter 12 at spaced points along the length of the bracket so that this structure effectively resists bending moments applied to the eyebolt 22 via the pedestal 14. The combination of the pedestal 14 with a high modulus of stiffness being secured to the rafter bracket 34 substantially over the depth of the rafter, together with the lengthy contact area between the anchor and the rafter means that the roof anchor device provides a structure which provides a substantially stiffer anchorage which results in minimal movement under load and thus maintains the integrity of the waterproof seal and avoids damage to adjacent tiles. In addition, there is no disruption of the integrity of the rafter and, furthermore, because the pedestal assembly is secured to the rafter plate substantially over the depth of the rafter, the structure is able to resist high torsional and lateral bending moments with less strain or

movement at the eyebolt than is the case with existing structures.

Reference is now made to Fig. 4 of the drawings which depicts a roof anchor 10 as shown in Figs. 1-3, but modified so that the device can be used on end gables and hip-end roofs. Fig. 4 is a diagrammatic view of a cross-section through a hip-end of a roof with the anchoring device mounted on a rafter as previously described, but with an additional support oriented substantially perpendicular to the slope of the roof.

The principal advantage of the arrangement hereinbefore described is that the structure provides greater stiffness at high bending moments than is possible with existing structures and it also satisfies the existing British Standard and TRADA (Timber Research & Development Association) requirements. The structure is readily useable on end gables and hip-end roofs and can be further modified to receive an additional structure for connecting primary and secondary rafters on end gables and hip-end roofs so as to resist far higher lateral and torsional bending moments, it is advantageous to modify the structure shown in Figs. 1-3. This is achieved by providing a lateral support in the form of a shallow U-shaped channel member 60, one end of which 62 is welded to the U-shaped bracket 34 between the pedestal 14 and the U-clamp 42. The next adjacent rafter, known as a secondary rafter 64, has a U-shaped bracket 66 fastened

thereto in a similar manner to lower bracket 34. An adjustable channel 68 is welded at its end 70 to the bracket 66 and it fits within the channel member 60. The channel members 60,68 have overlapping apertures 72,74 which permit the channel members 60,68 to be fastened to each other along their length by bolts (not shown).

With this arrangement, the lateral applied forces to the eyebolt 22 are resisted by means of the channel members 60,68 which together act as a tie and fastens the primary rafter 12 to the secondary rafter 64, thus providing a more secure and stable structure capable of resisting far higher lateral and torsional bending moments than is the case with the existing devices.

Reference is now made to Figs. 5 to 7 of the drawings which depict a roof anchor generally indicated by reference numeral 110 mounted on a rafter 112. The roof anchor 110 consists of rafter attachment means 111 for securing the device 110 to the rafter 112 and harness attachment means 113 in the form of a pedestal 114 which projects through the sarking 116, tiles 118 and lead slatepiece 120 and which terminates in a proprietary eyebolt 122 such as a BS5845 type eyebolt, for example a Hilti (trademark) or Centuryan (trademark) eyebolt, to which a lanyard with safety harness can be fastened in the usual manner. The eyebolt 122 extends through the length of the pedestal 124 and the bottom of a bracket in the form of a plate 126. The pedestal is circular in

cross-section and is welded on each side by welds 128 to the rafter attachment means 111 as best seen in Figs. 5 and 6.

This secure fastening of the eyebolt 122 through the pedestal 114 and of the pedestal 114 to the rafter attachment means, ensures that any bending moment applied via the eyebolt 122 to the rafter attachment means 111 is strongly resisted.

The rafter attachment means 111 comprises a first generally L-shaped bracket 130 of substantially the same depth as the rafter 112 and which extends along the length of the rafter for a distance which is greater than the length of the pedestal 114. The L-shaped plate 130 is fastened to the rafter 112 at upper and lower ends by upper and lower brackets generally indicated by reference numerals 132 and 134, respectively. Upper bracket 132 consists of a primary bracket portion 136 which is generally L-shaped and which fits around the rafter as shown and which projects or extends beyond the base of the rafter to form the plate 124 beneath the pedestal 114 and to which the nut 124 is secured. The other end of bracket 136 has a lug 138 which is connected by a bolt connection to a top plate 140 which also extends beyond the top of the rafter on either side of the pedestal 114 which also pass through the sarking to be received in a similar aperture in the L-shaped plate 130.

The lower bracket 134 comprises a first U-shaped

bracket element which fits around the rafter 112 and which has apertures for receiving bolts 145 which pass through the bracket and also through a similar aperture in L-shaped bracket 130. The bolts 145 are received by apertures of a top plate 146 so that the lower end of the rafter attachment means is securely fastened to the rafter 112.

It will be appreciated that the rafter bracket is securely fastened to the rafter 112 by brackets 132,134 which are sufficiently spaced-apart along the length of the rafter so that this structure effectively resists bending moments applied to the eyebolt 122 via the pedestal 114. The combination of the pedestal 114 being secured to the rafter bracket 130 substantially over the depth of the rafter, together with the widely spaced-apart anchor points on the rafter means that the roof anchor device provides a structure which resists far higher bending moments applied to the eyebolt than is possible with the prior art structures. In addition, there is no disruption of the integrity of the rafter and, furthermore, because the pedestal assembly is secured to the rafter plate substantially over the depth of the rafter, the structure is able to resist much higher torsional and lateral bending moments than is the case with existing structures.

Reference is now made to Fig. 8 of the drawings which depicts a roof anchor 110 as shown in Figs. 5 to 7, but

modified so that the device can be used on end gables and hip-end roofs. Fig. 8 is a diagrammatic view of a cross-section through a hip-end of a roof with the anchoring device mounted on a rafter as previously described, but with an additional support oriented substantially perpendicular to the slope of the roof.

The principal advantage of the arrangement hereinbefore described is that the structure is capable of resisting far higher bending moments than is possible with existing structures and it also satisfies the existing British Standard and TRADA requirements. The structure is readily useable on end gables and hip-end roofs and can be further modified to receive an additional structure for connecting primary and secondary rafters on end gables and hip-end roofs so as to resist far higher lateral and torsional bending moments, it is advantageous to modify the structure as shown in Figs. 5 to 7. This is achieved by providing a lateral support in the form of a shallow U-shaped channel member 150, one end of which 152 is welded to the pedestal support angle near weld location 128. The next adjacent rafter, known as a secondary rafter 154, has a U-shaped bracket 156 fastened thereto in a similar manner to lower bracket 134. An adjustable channel 157 is welded at its end 155 to the bracket 154 and it overlaps the support channel 150, as shown in Figs. 8 and 9. The support channel 150 and the adjustable channel 157 have overlapping apertures 158 which permit

the channels 150 and 157 to be fastened to each other along their length by bolts 160 as best seen in Fig. 8.

With this arrangement, the lateral applied forces to the eyebolt 122 are resisted by means of the channels 150,157 which together act as a tie and fastens the primary rafter 112 to the secondary rafter 154, thus providing a more secure and stable structure capable of resisting far higher lateral and torsional bending moments than is the case with the existing devices.

Reference is now made to Figs. 10, 11a and 11b of the drawings which depict a further alternative embodiment of roof anchoring device. In this embodiment pedestal 170 is received in a channel 172 (Fig. 11a) in an anchorage bracket 174 provided by an end plate 176 and an S-shaped plate 178 which are welded at one end 180,181 to the bracket 174. There is a gap 182 between the plates 176,178 and the pedestal 170 can be slid by the installer in-situ in the channel 172. When the pedestal is adjusted to its correct height, so that the eyebolt 183 projects over the tiles 185, it is securely fastened in position by bolting the ends of plate 176,178 together by bolts 184 as shown in Fig. 10. Thus, this embodiment, like the first embodiment, also permits in-situ height adjustment of the pedestal 170 relative to the anchorage bracket 174 and allows the roof anchor to accommodate variations in roof-line above the rafter thereby avoiding, 1) the requirement of a range of sizes and, 2)

pre-measurement of rafter-roof spacing prior to installation. This results in a substantial reduction in installation time and hence cost of installation.

It will be appreciated that various modifications may be made to the embodiments hereinbefore described without departing from the scope of the invention. For the embodiments of Figs. 1 to 11 the bracket and pedestals are designed in various sizes so that they accommodate the standard TRADA sizes, although it is possible to use an adjustable bracket to accommodate varying pedestal sizes and the pedestal need not be permanently anchored to the bracket in this regard. The length of the bracket in the first embodiment may be varied as required. All brackets are made from galvanised mild steel, but may be replaced by any other suitable material complying with the anchoring requirements.

The principal advantage of the arrangement hereinbefore described is that the structure is much stiffer at the eyebolt and is capable of resisting far higher bending moments than is possible with existing structures and it also satisfies the existing British Standard and TRADA requirements. The structure is readily useable on end gables and hip-end roofs and can be further modified to receive an additional structure for connecting primary and secondary rafters on end gables and hip-end roofs. The supporting pedestal being secured to the rafter bracket substantially across the depth of the rafter provides for

far higher resistance of bending moments applied to the eyebolt than is possible with existing structures. A further advantage is obtained by spacing the rafter bracket securement points much further apart than in existing structures or using a long bracket as shown in Fig. 1. This also contributes to the increased resistance to bending moments when the structure is used on a sloping roof. A further advantage is that the anchor device is capable of being fitted to a wide variety of rafter sizes and rafter spacings without destroying the integrity of the rafters and the pedestal can be adjusted in-situ in some embodiments to obviate the need for a range of pedestal sizes and avoid the need for pre-measurement of the rafter-roof spacing.

CLAIMS

1. An anchoring device for use on a roof having a plurality of beams or rafters with external covering means thereon, said anchoring device having beam or rafter attachment means for securing to a beam or rafter and roof anchor means having support means secured to said rafter attachment means at least at spaced apart upper and lower points, and said support means having a cross-section sufficient to provide a modulus of stiffness so that the roof anchor means is subject to minimal deflection when loaded under intended conditions.

2. An anchoring device as claimed in claim 1 wherein the roof anchor means further comprises harness attachment means for projecting through the roof covering, said support means being coupled between the harness attachment means and the rafter attachment means.

3. An anchoring device as claimed in claim 2 wherein the harness attachment means is an eyebolt and the support means is a tubular pedestal through which the eyebolt passes.

4. An anchoring device as claimed in claim 3 wherein the tubular pedestal is welded to the rafter attachment means over the depth of the rafter attachment means.

5. An anchoring device as claimed in claim 3 wherein the pedestal is secured to the rafter attachment means by friction and the pedestal is adjustable relative to the

rafter attachment means in-situ.

6. An anchoring device as claimed in any preceding claim wherein the rafter attachment means is a U-shaped channel member secured to the rafter over its length, said channel member having an aperture to receive the pedestal, and bracket means for clamping said pedestal.

7. An anchoring device as claimed in any one of claims 1 to 5 wherein the rafter attachment means is secured to the rafter at points which are spaced apart a distance greater than the length of the roof anchor means.

8. An anchoring device as claimed in any one of claims 1 to 5, and 7 wherein the rafter attachment means consists of a substantially L-shaped bracket located along one side of the rafter and which is secured by brackets at two spaced-apart points along the length of the rafter.

9. An anchoring device as claimed in any one of claims 3 to 8 wherein the tubular pedestal is of circular cross-section.

10. An anchoring device as claimed in any one of claims 3 to 8 wherein the pedestal is square or any other suitable cross-section.

11. An anchoring device as claimed in any preceding claim including second rafter attachment means for location on a second rafter adjacent said rafter, and support means coupled to said first and said second rafter attachment means, the arrangement being such that, in use, said additional support is substantially lateral to the slope

of the roof.

12. An anchoring device as claimed in claim 11 wherein said support means is adjustable whereby the distance between said first and second rafter attachment means can be adjusted.

13. An anchoring device as claimed in any one of the preceding claims wherein the rafter attachment means is secured to a beam or rafter over a distance greater than the depth of the rafter.

14. An anchoring device substantially hereinbefore described with references to Figs. 1 to 4; to Figs. 5 to 9, or Figs. 10,11 of the accompanying drawings.

**Patents Act 1977**
**Examiner's report to the Comptroller under Section 17 (The Search Report)**

Application number
9125717.0

**Relevant Technical fields**

(i) UK Cl (Edition K ) E15 (SL)

(ii) Int Cl (Edition 5 ) E04G

Search Examiner
A H MITCHELL

**Databases** (see over)

(i) UK Patent Office

(ii)

Date of Search
4 MARCH 1992

Documents considered relevant following a search in respect of claims
1-14

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|---|---|---|
| X | GB 2219826 A (CAMPBELL) note the bolt 5 and plates 6,7, Figure 3 | 1,2 |
| A | GB 2071196 A (FULTON) referred to on page 1 | 1,2 |
| X | US 4932185 (LEBEL) bolt 30 acts as an anchor means | 1,2 |
| X | US 4171032 (LEE) see Figure 2 | 1,2 |
| X | EP 0141730 A2 (FOURNIER) | 1,2 |

| Category | Identity of document and relevant passages | Relevant to claim(s) |
|---|---|---|
| | | |

## Categories of documents

X: Document indicating lack of novelty or of inventive step.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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